Multi-Grid Probe for Glow Discharge Plasma Analysis

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- Develop a technique for determining energy distribution of ions in plasma
- Test it against other proven techniques
- Find correlation between spectral line intensities

**Goals**
- Develop software for data acquisition and analysis
- Cost effective alternative to mass/energy analyzer
- Costs $150,000

**Experimental Setup**
- 4 precise spectrometers ranges
  - 200-400nm
  - 400-600nm
  - 600-800nm
  - 800-1000nm
- 1 broad spectrometer for 400-1000nm range

**Probe Theory**
- Plasma enters through small hole
- First grid is grounded
- Separates probe from plasma
- Second grid is below ground
- Filters out primary electrons
- Third grid is swept through a potential range
- Filters out ions that are below that energy level
- Fourth grid is grounded
- Sets a reference potential for the collector
- Fifth grid is below ground
- Filters out secondary electrons emitted by third grid
- Collector is grounded or negatively biased
- Helps collection of ions
- The derivative of the graph is taken to show the ion energy distribution function (IEDF)

**Probe Design**
- Cross section of probe in SolidWorks
- Screw holds tension on grid assembly
- Grids are stainless steel
  - Have tails to allow soldering to wires
  - Collector is graphite
  - Has grid behind it to allow for easy connection
- Housing is stainless steel
- Everything else is PTFE
- Hole in side for wires to run to chamber wall

**Future Work**
- Calculate concentration of different species from spectra
- Determine electron temperature from spectra
- Compare results with Langmuir probe
- Test GEA in glow discharge environment
- Finish computer interface
- Allow for real time updates from probe